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HALDANE AND MODERN BIOLOGY

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XVI. HALDANE'S BIOLOGY AND SOCIAL INSIGHT

Haldane was one of the most consistent exponents of the necessity for building a scientific outlook for the recognition and solution of the world's social problems. His irrepressible rationalism led him to a commitment to dialectical materialism as the best of available choices, but this commitment did not inhibit him from exercising his egregious critical faculties without hindrance. When he had to speak out against unscientific perversions of the rational society, he did so. Certainly, it was the ironic tragedy of his philosophical life that it was precisely in the field of genetics that authoritarian dogma in the Soviet Union perpetrated the worst travesties of pseudo-science under the leadership of Lysenko.

Even this conflict had its creative side, leading Haldane to look especially critically at the misapplications of Mendelian thinking to human affairs, in what might be regarded as a partial balancing of the sins of the western democracies against those of the communist dictatorship. On the negative side, the conflict tended to isolate Haldane from many of his closest intellectual confreres, particularly in the U.S.

Haldane's social commentary today may seem naively overoptimistic in places: let the scientific attitude merely have a proper trial, and all would be well with the world. Quite possibly, the USSR would be just the arena in which such a revolutionary development might have the best chance to become rooted. The world seems far more complicated today; a little science seems more likely to usher in the *Brave New World* than a Wells-Haldane form of utopia. It is perhaps more than a trivial coincidence that Haldane's most striking prophetic misjudgment had to do with the time it would take for the practical realization of atomic energy. This scientific catastrophe, more than any other, has exploded the peaceful dreams of social scientism.

Nevertheless, Haldane's insistent demand for the incorporation into politics of scientific thinking and of the actual facts of scientific reality is more relevant today than ever. His writings have already had a deeper impact on contemporary thought than is widely recognized, but most of them are (incomprehensibly!) out of print and not as well known as they should be to a contemporary generation.

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My original intention had been to write a longer critical commentary on Haldane's prophetic writings. Its realization was inhibited by Haldane's own eloquence: what commentary could compete with his own words? I have, therefore, tried to prepare a special treat, a brief anthology of epigrams culled from his collected essays[1] (1932, Chatto and Windus, London). In doing this, I have applied only one bias—to look for the more universal insights and to relieve his own emphasis on dialectical materialism as the philosophical, or perhaps motivational, basis for his comments. This bias may make his commentary more significant to a wider readership. I doubt that he would ever have forgiven me for it.

The enemies of science alternately abuse its exponents for being deaf to moral considerations and for interfering in ethical problems which do not concern them. Both of these criticisms cannot be right.

Preventive medicine could be made into the moral equivalent of war. It is already so for a few people. A colleague of mine was recently translating a French paper on chemotherapy when he came upon the phrase "tué par l'ennemi" in reference to a deceased pharmacologist. "I suppose," he said, "that means that he died of an accidental infection." I undeceived him; the enemy in this case had been the German nation; but his attitude was typical of medical scientists to-day. "For we wrestle, not against flesh and blood, but against principalities, against powers, against the rulers of the darkness of this world." St. Paul thought that the world was largely ruled by demons. We know better to-day, and we demand the general adoption of the scientific point of view because in its absence human effort is so largely devoted to conflicts with fellow-men, in which one, if not both, of the disputants must inevitably suffer. It is only in times of disaster that the average man devotes a moment's thought to his real enemies, "the rulers of the darkness of this world" from bacteria to cyclones. Until humanity adopts the scientific point of view those enemies will not be conquered.

But until the scientific point of view is generally adopted, our civilization will continue to suffer from a fundamental disharmony. Its material basis is scientific, its intellectual framework is pre-scientific. The present state of the world suggests that unless a fairly vigorous attempt is made in the near future to remedy this disharmony, our particular type of civilization will undergo the fate of the cultures of the past.

[1] The following quotations (an abridgment of pp. 3–224 of *Science and Human Life*, by J. B. S. Haldane, copyrighted 1933 by Harper & Brothers; renewed 1961 by J. B. S. Haldane) are reprinted by permission of Harper & Row, Publishers. Acknowledgment is also made to the British publishers, Chatto & Windus, Ltd., who published the same book under the title, *The Inequality of Man and Other Essays* (1932).

Now we cannot at present control segregation, except to a small extent, but we can and do control heredity in animal and plant breeding, and could in human society if eugenics became a reality. That is why eugenics is at present the only possible way of improving the innate characters of man. But for all that, biology does not support the idea that the hereditary principle is a satisfactory method of choosing men or women to fill a post. Segregation sees to it that very few human characters breed true. The average degree of resemblance between father and son is too small to justify the waste of human potentialities which an hereditary aristocratic system entails. If human beings could be propagated by cutting, like apple trees, aristocracy would be biologically sound. England would presumably be governed by cuttings of Cromwell and Chatham; America, as I believe Bateson once suggested, by cuttings of Washington and Lincoln. But until the art of tissue culture has developed very considerably, such possibilities need not even be thought of.

It is, of course, irrational that each man's vote should possess equal value. But the alternatives so far tried or suggested are still less rational. They usually take the form of increasing the political power of those who are wealthy enough to be able to influence politics already. One eminently desirable reform would be the disfranchisement of persons over sixty-five years of age. The main effects of their votes will not appear during their lifetime; they would be useless in a civil war, and their political views depend on issues of a generation ago. In England our old men and women vote for a protective tariff because they were formerly opposed to Irish Home Rule, in America because their childish sympathies in the Civil War were for the North!

I like philosophers, and I believe that they fulfil a function of great importance. There are a very large number of questions with regard to which there is no satisfactory evidence, and it is important that they should be considered as open. Now agnosticism is an intellectual tight-rope which most people cannot tread for long.

"The materialist," [Eddington] says, " . . . must presumably hold the belief that his wife is a rather elaborate differential equation, but he is probably tactful enough not to obtrude this opinion in domestic life." I recently put this point to a happily married physicist of my acquaintance. He replied that he would not love his wife if he did not believe that she was a differential equation, or rather that her conduct obeyed one. He loves her because she has a definite character which renders her conduct intelligible even when it is surprising. And in this she certainly resembles a differential equation. There are dull differential equations just as there are dull wives.

If innate human diversity is an ineradicable fact, the ideal society is one in which as many types as possible can develop in accordance with their possibilities. So far every society has tended to idealize one particular type.

Moral indignation is regarded as out-of-date. It has its uses, but it is the finest known excuse for cruelty, just as cruelty is the best excuse for moral indignation. I regret to say that my bosom often swells with moral indignation against all kinds of people whom it would be more rational to pity for their conduct.

A certain fraction of human conduct is largely controllable by social pressure, and praise and blame are effective means of controlling it. They prevent a large number of bad actions. But they do not, as it seems to me, involve any particular view as to the freedom of the will. They are part of the environment which determines our actions. Every crime represents a failure of society to control a criminal, as well as a failure on the part of the criminal to respond to social control. We do not at present know enough of biology to alter the structure of the criminal's brain and mind; or to prevent potential criminals being born; we must take him as we find him, and attempt so to order society that he does not commit crime.

At present the principal clue to the spot where civilization began comes from an entirely unexpected source, namely, plant genetics. Civilization is based, not only on men but on plants and animals.

For example, maize, as compared with wheat or oats, is very poor in vitamin B2. Hence populations living mainly on maize get a skin disease called pellagra. This is probably one reason why the maize-civilizations of central America never reached the level of the wheat, barley, and rice civilizations of the old world.

Between 3000 B.C. and A.D. 1400 there were probably only four really important inventions, namely the general use of iron, paved roads, voting, and religious intolerance.

Christianity and other religions have, of course, on occasion been great weapons in the hands of moral reformers, but they have also been effectively used for the opposite purpose. To take an obvious example, slavery, and what is worse, slave-raiding, still exist in Christian Abyssinia, the latter evil nowhere else.

The man who is probably the greatest living experimentalist once said to me that but for Galileo and men like him he would never have thought of using experiment rather than unaided observation and thought to search out the nature of things. If Galileo and a few more like-minded men had been burned

alive at an early age we might very possibly still be living under a civilization not greatly different from that of the Middle Ages.

It is only in the last hundred years that civilization, after six thousand years, has begun to change all through. But to-day the external conditions of life in civilised communities differ more from those of 1829 than did the conditions of 1829 from those at the time of Noah's flood. And this change, the real world revolution, has only just begun. We have gone an immense way in improving and organizing production and communication; we have nearly abolished water-borne and insect-borne diseases, and that is about all. Science has not yet been applied to most human activities. It can be, and I hope will be, applied to all.

The world is, of course, full of alleged applications of science outside the realms of production and hygiene, but the vast majority of them show no trace of scientific method. Thus there are numberless systems of education which are supposed to be based on scientific child psychology. But they are usually applied to small groups of children, in many cases to the children of unusually intelligent parents, brought up in unusually intelligent homes. If such children later turn out to be more successful than the average, this proves nothing at all.

Who, then, have been the real world-revolutionaries, the men who have done such deeds that human life after them could never be the same as before? I think that the vast majority of them have been skilled manual workers who thought about their jobs. The very greatest of them are perhaps two men or women whose real names will remain forever unknown, but whom we may call Prometheus and Tiptolemus, the inventors of fire and agriculture. Prometheus, who was a Neanderthal man[1] with great brow ridges and no chin, discovered how to keep a fire going, and how to use it to such advantage that his successors were induced to imitate his practice. Probably some later genius discovered how to kindle a fire by rubbing sticks together, and I like to imagine that it was a woman who first presented her astonished but delighted husband with a cooked meal. Fire was a very ancient invention, made in the early part of the old Stone Age, but apparently seeds were first systematically sown not so very long before the dawn of history. The immediate result was to make possible a fairly dense and settled population in which civilization was able to develop.

Those intellectuals who have also been intelligent with their hands have mostly confined their writing to scientific and technical questions. Perhaps I

[1] Recent excavations in China suggest that the ape-man Sinanthropus possessed fire. Prometheus lived longer ago than I thought.

ought to do so myself. But when I look at history, I see it as man's attempt to solve the practical problem of living. The men who did most to solve it were not those who thought about it, or talked about it, or impressed their contemporaries, but those who silently and efficiently got on with their work.

The great majority of us are quite capable of some kind of useful activity. The essential social problems of to-day, as they present themselves to a biologist, are to determine the abilities of different people, and to organize society so that the demand for various kinds of human ability should equal the supply.

There is plenty of room at the top. In biology we need men with a knowledge not only of the biological sciences, but of mathematics, physics, chemistry, and sociology. Without such supermen biology will break up into a group of isolated sciences divorced from one another, and from human life. Our needs in literature are essentially similar.

Very few serious attempts . . . are made to portray society as a whole, which it is. And such attempts generally fail because of the immense reach required in a mind which is to do the kind of thing which H. G. Wells has occasionally accomplished.

We cannot expect nature to start improving our innate abilities once more. The usual fate of a species in the past has not been progress, but extermination, very often after deteriorating slowly through long periods. The animals and plants alive to-day are the descendants of the few species which have escaped this fate. There is no reason to suppose that man will escape it unless he makes an effort to do so. And we do not at present know how to make that effort. Doubtless complete idiots should be prevented from breeding, but the effort to eliminate all sorts of "unfit" human types is a very much more dubious proposition. When I hear people talking of the "elimination of the unfit" I am always reminded of the crowd who shouted at St. Paul, "Away with such a fellow from the earth, for it is not fit that he should live." St. Paul was eliminated, and very possibly would be to-day. Many of the "unfit" are unfit for society as it is to-day, but that is often society's fault. The attempt to prevent them from breeding really involves the appalling assumption that society as at present constituted is perfect, and that our only task is to fit man to it. That is why eugenists are generally conservative in their political opinions. It also goes a long way to explain the objection which many religious people feel for negative eugenics. They regard it as interference with God's will. I do not share this view, but still less do I regard the average medical board or bench of magistrates as qualified to direct the evolution of the human race.

Pictures of the future are myths, but myths have a very real influence in the present. Modern political ideas are very largely the creation of the Jewish prophets, who foresaw the new Jerusalem in the future, at a time when their contemporaries of other nations had no particular hopes for the betterment of humanity. History has certainly been very different from what Isaiah and Daniel believed it would be; but they helped to make it what it is, and perhaps they would not be altogether dissatisfied with it if they could live to-day. Our greatest living mythologist, Wells, is certainly influencing the history of the future, though probably in ways which he does not suspect.

The time will probably come when men in general accept the future evolution of their species as a probable fact, just as to-day they accept the idea of social and political progress. We cannot say how this idea will affect them. We can be sure that if it is accepted it will have vast effects. It is the business of mythologists to-day to present that idea. They cannot do so without combining creative imagination and biological knowledge.

Science impinges upon ethics in at least five different ways. In the first place, by its application it creates new ethical situations. Two hundred years ago the news of a famine in China created no duty for Englishmen. . . . To-day the telegraph and the steam-engine have made such action possible, and it becomes an ethical problem what action, if any, is right. Secondly, it may create new duties by pointing out previously unexpected consequences of our actions. We are probably divided as to the duty of vaccinating our children, and we may not all be of one mind as to whether a person likely to transmit club-foot or cataract to half his or her children should be compelled to abstain from parenthood.

Thirdly, science affects our whole ethical outlook by influencing our views as to the nature of the world—in fact, by supplanting mythology. One man may see men and animals as a great brotherhood of common ancestry. . . . Another will regard even the noblest aspects of human nature as products of a ruthless struggle for existence. . . . A third, impressed with the vanity of human efforts amid the vast indifference of the universe, will take refuge in a modified epicureanism. In all these attitudes and in many others there is at least some element of rightness. Fourthly . . . anthropology . . . is bound to have a profound effect . . . by showing that any given ethical code is only one of a number practised with equal conviction and almost equal success; finally, ethics may be profoundly affected by an adoption of the scientific point of view; that is to say, the attitude which men of science, in their professional capacity, adopt towards the world. This attitude includes a high (perhaps an unduly high) regard for truth, and a refusal to come to unjustifiable conclusions . . . agnosticism.

If the great aim of education is to know yourself, it is essential to begin at the beginning—namely, with anatomy and physiology. If an almost equally important aim is to promote human solidarity, it is in the realm of hygiene that

this is most completely displayed. On the political and economic plane my neighbours' misfortune may be my advantage; in that of hygiene this is never so.

The usual course of study for would-be politicians is, I believe, history. I think that the study of history is somewhat fallacious owing to the enormous changes which have taken place in the last fifty years. For example, up till fifty years ago every State was based on the presupposition that most of the population would have to spend the greater part of their time in hard physical work. That is no longer the case. It seems to me that facts such as that make the lessons of history a little dubious in their application to modern problems.

Biology may not be taught to children seriously; that is to say, it may not be taught to them in connection with their own lives. Human physiology and genetics upset quite a number of our prejudices. The physiology of digestion, reproduction, and excretion are indecent; the physiology of the brain is irreligious. On the other hand, chemistry, physics and certain branches of botany have no immediate bearing on conduct, and therefore they do not come into conflict with any deep-seated prejudices, and are taught in schools. It has, moreover, been found that a good course of systematic botany, taught on the lines of Greek grammar, can immunize the average child against any further interest in science.

If the structure of society is such that the best stocks in it are being bred out, we must change that structure. If the rich limit their families it is, largely, I believe, for two reasons: they want to be able to leave money to their children and they want to be able to afford an expensive education for them. To my mind, the obvious moral to be drawn is that it would be a eugenic measure to abolish hereditary wealth, and have one, and only one, school system for all the population.

In the past it has been an historical function of religion to hold up before humanity a transcendental ideal, however imperfectly presented. If the only function of religion is to establish the Kingdom of God on earth, the Socialists say, "We can do it better than you." To-day it seems to me that transcendental ideals which take men out of the field of ordinary life are only active in the realms of science and art.

It is quite possible, I think, that as the ideals of pure science become more and more remote from those of the general public, science will tend to degenerate more and more into medical and engineering technology, just as art may degenerate into illustration and religion into ritual when they lose the vital spark.

Now I am not going for one moment to suggest that there is not a very grave danger for science in so close an association with the State. It may possibly be that as a result of that association science in Russia will undergo somewhat the same fate as overtook Christianity after its association with the State in the time of Constantine. It is possible that it may lead to dogmatism in science and to the suppression of opinions which run counter to official theories, but it has not yet done so.

Even now psychology is beginning to become scientific. I do not think that the results of scientific psychology are yet very clear, but if we start trying to take a scientific attitude about our own behaviour, looking at ourselves objectively, the first thing we do is to laugh, and that has an extremely good effect on our behaviour.

Even if man does not perish in this dramatic manner, there is no reason why civilization should not do so. All civilization apparently goes back to a common source less than ten thousand years ago, possibly in Egypt. It is a highly complicated invention which has probably been made only once. If it perished it might never be made again.

A modern world followed by revolutions might destroy it all over the planet. If weapons are as much improved in the next century as in the last, this will probably happen. But unless atomic energy can be tapped, which is wildly unlikely . . . the odds are slightly against such a catastrophic end of civilization.

If science is to improve man as it has improved his environment, the experimental method must be applied to him. It is quite likely that the attempt to do so will rouse such fierce opposition that science will again be persecuted as it has been in the past.

Again, if scientific psychology and eugenics are used as weapons by one side in a political struggle, their opponents, if successful, will stamp them out. I think that it is quite as likely as not that scientific research may ultimately be strangled in some such way as this before mankind has learnt to control its own evolution.

If so, evolution will take its course. And that course has generally been downwards. The majority of species have degenerated and become extinct, or, what is perhaps worse, gradually lost many of their functions. The ancestors of oysters and barnacles had heads. Snakes have lost their limbs and ostriches and penguins their power of flight. Man may just as easily lose his intelligence.

It is only a very few species that have developed into something higher. It is unlikely that man will do so unless he desires to and is prepared to pay the cost.

It was possible either to suppose that life had been supernaturally created on earth some millions of years ago, or that it had been brought to earth by a meteorite or by micro-organisms floating through interstellar space. But a large number, perhaps the majority, of biologists, believed, in spite of Pasteur, that at some time in the remote past life had originated on earth from dead matter as the result of natural processes.

It is probable that all organisms now alive are descended from one ancestor, for the following reason. Most of our structural molecules are asymmetrical, as shown by the fact that they rotate the plane of polarized light, and often form asymmetrical crystals. But of the two possible types of any such molecule, related to one another like a right and left boot, only one is found throughout living nature.

There is nothing, so far as we can see, in the nature of things to prevent the existence of looking-glass organisms built from molecules which are, so to say, the mirror-images of those in our own bodies. Many of the requisite molecules have already been made in the laboratory. If life had originated independently on several occasions, such organisms would probably exist. As they do not, this event probably occurred only once, or, more probably, the descendants of the first living organism rapidly evolved far enough to overwhelm any later competitors when these arrived on the scene.

It is doubtful whether any enzyme has been obtained quite pure. Nevertheless, I hope to live to see one made artificially.

Our social organization of to-day is so rudimentary that one feels justified in hoping that our present lives are very poor samples. There is no physical reason, so far as we know, why our humanity should not continue for thousands, perhaps millions, of millions of years more; and it is reasonable to hope that they will, on the whole, be happier than the present or past ages.

If, however, evolution continues, it is likely that in most of our past and future lives you and I have been or will be relatively feeble-minded throwbacks among a more perfect humanity.

As a man I am a biologist, and see the world from an angle which gives me an unaccustomed perspective, but not, I think, a wholly misleading one.

A survey of the beliefs which intelligent men in the past have held as certainties makes that sufficiently clear. One cannot order one's life without a set of beliefs of some kind. But the intellectually honest man must recognize the utterly provisional nature of his beliefs.

The psychological, even the intellectual, benefits of marriage, seem to me to be enormous. If a man has lived for some years in the closest intimacy with a woman, he learns to look at life from her point of view as well as his own. A man who cannot do this is like a man blind in one eye. He does not appreciate the solidity and depth of the world before him. The ideas I am putting before you here are largely my wife's, or at any rate, family ideas, rather than my own private productions.

Finally, I am a human being, a citizen of the world which applied science is daily unifying. My own profession of scientific research knows no frontiers and no colour bars. Japanese, Indians, and Chinese, as well as Europeans and Americans, are, or have been, among my colleagues. I am naturally in favour of any measures tending to unify humanity and prevent war. But my views as to the best methods of achieving these aims are not informed by sufficient knowledge to be worth stating. For the same reason I am saying nothing about economics.

We still have intellectual, aesthetic, and spiritual starvation, which to my mind are greater evils than any mere economic inequality. Until our educational system is so altered as to give a fair deal to every boy and girl who desires a first-rate education and is capable of benefiting by it, my political views are likely to remain, as they are now, on the left.

There is a worse evil than intellectual starvation, and that is the deliberate suppression of free thought and free speech. I rejoice to live in a free country where this evil, though it exists, is less serious than in most other countries.

I am a part of nature, and, like other natural objects, from a lightning flash to a mountain range, I shall last out my time and then finish. This prospect does not worry me, because some of my work will not die when I do so.

In this age of applied science it is gradually being realized in some circles that, if civilization is to continue, scientific thought must be applied to men as well as to nature. Hence the public is beginning to try to understand how scientific workers approach a problem. And here they are at once confronted with the curious but, as we shall see, quite intelligible inarticulateness of most scientific workers.

I am interested not only in the progress of science, but in trying to detect the still, small voice of common sense among the shouts of the anti-scientific and pseudo-scientific extremists.

Though not an adherent of any religion, I find religions an absorbing topic. They represent man's attempt to adjust himself intellectually and emotionally to the universe. The intellectual side of this effort interests me mainly because of its fantastic character. . . .

But the emotional side seems to me an altogether more serious affair. If science is not to leave a gap which will inevitably be filled with superstition, man must learn to feel himself a citizen of the universe as depicted by science. Fortunately I know that such a state of mind is possible.

I am less interested than the average person in politics because I am convinced that all the political principles of to-day are makeshifts, and will ultimately, though not in my time, be replaced by principles based on science.

Women interest me, for I am a normal man, but my interest in them is not mainly intellectual. . . . The average boy is something of a scientist, and an artist too. . . . a fairly bright boy is far more intelligent and far better company than the average adult. I am interested in our increasing knowledge of the child's mental processes, but even more in the attempts which are being made, in the face of ferocious opposition, to teach the child the subject which most children find the most fascinating of all, namely human biology. . . . The child represents the hope of humanity. We are not giving our children a fair deal. Many of those who could benefit most from higher education do not get it. Others are given more education than they either want or can assimilate. Hardly any are introduced to the scientific outlook until their minds have been so filled with pre-scientific ideas as to make scientific thought very difficult. I think that justice for children is even more important than justice for adults . . . as a biologist I realize that all men are different, and I do not offer them [my thoughts] as a pattern for others.